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The two photographs were made by Dr. B. O. Dodge, of Columbia University, and Miss Bernice Replogle of Bur Oak, Michigan.

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RUSTS OF THE WEST INDIES¹

BY J. C. ARTHUR

The rusts of the West Indies are not well known, and the present discussion can do no more than call attention to a few salient features regarding their kind, number and distribution. The first attempt at a collective account of the West Indian rust flora was made only a year or so ago, when the rich Porto Rican material collected by Professor F. L. Stevens in 1913-15 was studied.² This list gave 155 species for all the West Indies, only 20 of which were not known from Porto Rico. Had a list been compiled before this material was available it would have numbered less than 100 species, of which over half would have been recorded for Porto Rico, about half for Cuba, somewhat less than half for Jamaica, less than one fifth for the Bahamas, and still fewer for the Lesser Antilles and other small islands.

During two months in the early part of the present year (1916) the second extensive search for rusts in Porto Rico was made by Prof. H. H. Whetzel and Dr. E. W. Olive, which added 20 species to those already known for the island, and 17 species to the West Indian list, bringing the total up to 174.

In the meantime Mr. J. R. Johnston of the Experiment Station of Cuba has been searching for rusts in central and eastern Cuba, and Mr. Percy Wilson, of the New York Botanical Garden, has taken many rusts in western Cuba, especially in the Isle of Pines. The study of the rich material from these two sources, with addition of other scattering collections, shows a present rust flora for Cuba of 136 species, among which are found an addition

¹ Read before the Botanical Society of America at the New York meeting, Dec. 29, 1916.

² Arthur, J. C.—Uredinales of Porto Rico based on collections by F. L. Stevens. Mycol. 7: 168-196, 227-255, 315-332; 8: 16-33. 1915-16.

of 40 species to the known West Indian flora, bringing it up to a total of 214 species.

This much for statistics, in which the islands of Haiti (Hispaniola) and Jamaica, the second and third largest of the West Indies, with their highly varied topography and climate, have an insignificant part. It can be said that the rust flora of Cuba and Porto Rico, the largest and the smallest of the four large islands, is about as well known as that of many of the states of the Union, but that Haiti and Jamaica are practically virgin territory, yet awaiting the rust collector. None of the smaller islands has yet been explored to any extent for rusts.

The area of the Greater Antilles, embracing the four large islands, lies just within the tropical zone, and a long way from the equator. Its relation to the equator is about the same as that of the region about Rio Janiero, Brazil, and it is with the rust flora of this region that the greatest similarity is shown.

The four islands range through a latitude of five degrees, or about the same as that of the state of Illinois or New York. It can not be expected, therefore, that their individual rust floras should show any large differences. While there is yet not enough known to justify close analysis, still it is clearly evident that the Cuban flora favors that of North America, having many characteristic species in common with southern Florida, Mexico and Central America, while the Porto Rican flora favors that of South America, with species in common with Venezuela, Colombia and southward.

Comparing the rust flora as a whole with that of temperate regions the most interesting feature is the adaptation of the several methods of spore propagation to climatic conditions for the maintainance of the species. About 65 per cent of the known species appear to propagate almost or quite wholly by urediniospores. These include not only tropical species, but many that in temperate regions commonly produce teliospores and complete their life cycle, such as *Uromyces appendiculatus* on the legumes and *Puccinia salviicola* on the labiates. Only about 10 per cent of the long cycle species make use of their full complement of

spores in maintaining their existence. The heavy preponderance of collections showing only urediniospores has long been recognized as one of the prominent difficulties in the taxonomic study of tropical rusts.

But doubtless the most unexpected feature of the flora is the large proportion of short cycle species. The opinions of Magnus and Eduard Fischer have generally prevailed, that a shortened life cycle is an indication of adaptation to a short season for growth, and that such species are more numerous on high mountains and far northward, where the brief growing seasons alternate with long periods of cold.

In the short cycle rusts the spores germinate for the most part while attached to the host plant, and dissemination is by the exceedingly small basidiospores, often called sporidia. The time required for one set of basidiospores to infect a plant, mature the fungus, and provide another crop of basidiospores averages from one to two weeks. It looks like a provision for a hurry-up development to escape extermination. But under a tropical sun in the Greater Antilles we find that 25 per cent of the species are short cycle forms. Evidently the explanation of this situation is not the one usually given.

Possibly the 65 per cent of species propagated by repeating spores, and the 25 per cent of short cycle species, are the expression of two ways the rusts have found to meet one and the same set of conditions that menace their existence. It is likely that some important problems in the elucidation of the very complex development and behavior of the rusts, such as this one, which have not been well worked out in temperate regions, may be studied to advantage in the tropics.

A more extended analysis of the West Indian rusts is scarcely advisable, considering the limited knowledge regarding them. To show how restricted our knowledge is it may be well to recapitulate. Altogether 214 species are recorded at this time for the West Indian islands. Of these 174 species are known to occur in Porto Rico, which has an area of 3,500 square miles, and only 136 species in Cuba, which is nearly thirteen times as large, having 44,000 square miles. Jamaica with 5,000 square

miles is practically unexplored in this regard, and Haiti with 30,000 square miles is a veritable *terra incognita*.

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SHORTER NOTES

CONCERNING SOME SPECIES OF *CHRYSOPSIS* IN COLORADO:—In studying my specimens of *Chrysopsis* I came to some conclusions which are somewhat different from the classification in our manuals. The genus is, of course, a rather difficult one, as the various treatments indicate, and I can only give my conclusions.

It seems to me that *Chrysopsis resinolens* A. Nelson and *C. fulcrata* Greene are the same species, and that since *C. fulcrata* was described earlier than *C. resinolens* it should replace that name. Dr. Greene sent me a specimen of *C. fulcrata*, and while it is a taller plant than any specimen of *C. resinolens* which I have seen, yet the main characters of leaf, the size of the flower-heads and their disposition at the end of the stem, the pubescence, and the resinous atoms on the leaves, are about the same. The species is quite variable according to localities in which it grows, and some forms might be distinguished, yet the plant I have from Dr. Greene and one I have from Prof. Nelson seem to be the same species.

Chrysopsis caudata Rydb. is not the same as *C. fulcrata*, but is a good species, distinguished by the different leaves and larger heads. *Chrysopsis amplifolia* Rydb. is much like *C. caudata* and I think may be referred to that species. *Chrysopsis horrida* Rydb. seems to be too close to *C. hispida* (Hook.) Nutt.

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REVIEWS

Atkins's Some Recent Researches in Plant Physiology *

As stated in the preface, the general aim of this book is to present to senior students and investigators the results of recent

* Atkins, W. R. G., Some Recent Researches in Plant Physiology. Pp. i-xi +328. With 28 illustrations. London. Whittaker & Co. 1916.